

First Street Plot 10a

Stage 2 Whole Life Carbon Assessment Report

Ask Real Estate

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Executive Summary

A Whole Life Carbon Assessment has been carried out for the First Street **Plot 10a** project in Manchester.

The assessment was carried out according to the recent British Standard BS EN15978:2011 (Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method), and the RICS Professional Statement 'Whole life carbon assessment for the built environment 2017'.

Embodied Carbon Targets

The development is to have a low embodied carbon and material use impact. The project comprises a 13-storey office building with a post-tension concrete structure. Its exterior will include precast concrete façade (60%) with glazing (40%) including openable windows covered by perforated aluminium panels.

In line with this context the 2020 LETI targets for a commercial office may be applicable as the LETI 2020 target for new construction is 600 kgCO₂e/m² without sequestration for substructure, superstructure, MEP, façade, and internal finishes.

Embodied Carbon Summary

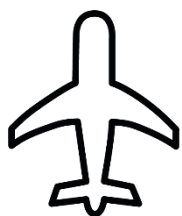
The total embodied carbon emissions for both Upfront Embodied Carbon and Whole Life Embodied Carbon over a period of 60 years are shown in Tables 1 and 2. This is based upon design workshops held with the various disciplines through the early design stages, focused studies and design information received, architectural and structural layouts and details.

The results for Plot 10a show the possibility to achieve the best possible embodied carbon result, the development needs to incorporate design elements to lower the embodied carbon further. The following results are aligned with LETI scope and do not include external works and F, F&E which are reported separately.

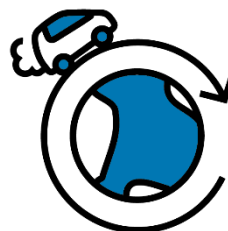
Plot 10a Emissions aligned with LETI SCOPE	Upfront Embodied Carbon LETI (A1-A3)	Transport (A4)	Site work (A5)	Whole Life Embodied Carbon incl. seq. (A-C)
Tonnes CO ₂ e	15,718	731	1,738	29,416
kgCO ₂ e/m ² (GIA)	547	25	60	1,023
LETI Rating System	632 (D)			D

Table 1: Embodied Carbon Summary (current design)

The **Whole Life Embodied Carbon** of the Plot 10a is the equivalent to:



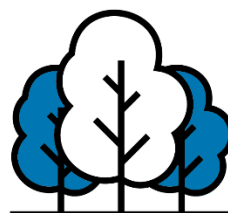
5,633
Personal Return flights
London - Hong Kong



3,291
Laps around the globe
by car



Energy to make
370,768,144
Cups of tea



219,371
Trees to absorb

Figure 1: Embodied Carbon Equivalent (Whole Life Embodied Carbon) for the whole development

Potential Reduction Opportunities

The assessment has identified a series of material alternatives that could be applied to the development to reduce its carbon footprint. These are as follows:

High cement replacement for concrete 70% GGBS in foundations, retaining wall, lowest floor construction.

Local sourcing of all in-situ concrete <10km in superstructure.

Structural steel frame made from recycled materials (produced from Electric Arc Furnace) – columns.

High cement replacement for concrete 50% GGBS in upper floors and roof.

Rockwool rigid insulation for flat roof.

Lower EC for the curtain walling.

Low carbon plasterboard (Fermacell or equivalent) internal partitions and walls.

Low carbon wall paint.

Low carbon ceramic floor finishes.

Reclaimed raised access floor system for offices.

If all the suggested options could be applied, the overall reduction of the **Plot 10a** carbon footprint could be 13%, which could result in an upfront embodied carbon intensity of 541 kg CO₂e/m², alongside LETI “C” rating.

Plot 10a (Aligned with LETI Scope)	Baseline Design	Potential
	Upfront Embodied Carbon LETI (A1-A5)	Upfront Embodied Carbon LETI (A1-A5)
Tonnes CO ₂ e	18,187	15,800
kgCO ₂ e/m ² GIA	632	541
LETI Rating System	D	C

Table 2: Whole life carbon comparison of baseline with potential improvement for Plot 10a for Options 1-10

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1.0

Introduction

1.0 Introduction

Cundall have been commissioned by Ask Real Estate to conduct a Whole Life-Cycle Carbon Assessment (WLCA) for Plot 10a in Manchester. This report summarises the findings.

The assessment was carried out in accordance with the British Standard BS EN15978:2011 (Sustainability of construction works - Assessment of environmental performance of buildings - Calculation method), and the RICS Professional Statement 'Whole life carbon assessment for the built environment 2017'.

1.1 Embodied Carbon targets

The development is to have a low embodied carbon and material use impact in line with the LETI 2020 targets for a commercial office. The LETI 2020 target is 600 kgCO₂e/m² without sequestration for substructure, superstructure, MEP, façade, and internal finishes.

1.2 Industry-wide targets & context

Industry-wide targets have been identified by the Royal Institute of British Architects (RIBA) and the London Energy Transformation Initiative (LETI). The industry bodies have set out a series of embodied carbon reduction targets towards whole life net zero.

It should be noted that the RIBA targets are performance targets to be realised in buildings completed in 2020, 2025 and 2030 (known as Built Targets), whereas the LETI targets relate to year of design (known as Design Targets). The RIBA targets also refer to life cycle stages A-C, whereas the LETI targets refer only to life cycle stages A1-A5.

Since LETI first released embodied carbon targets in 2020, LETI has been consulting with industry groups, including CIBSE, RIBA, IStructE, the GLA and the Whole Life Carbon Network to align definitions, scopes, measurement methodologies and targets.

In May 2021, LETI released a suite of documents relating to defining and aligning whole life carbon and embodied carbon targets and introduced a letter banding rating system to allow for quick comparison of ambition across various typologies and portfolios. Please find weblink to relevant documents [here](#).

LETI states that current best-practice performance for projects in the design phase is a "C" rating, while a "B" and above is considered a robust stretch target.

While the project's main aspiration is to meet the LETI 2020 Design Target (A1-A5), benchmarking against broader industry schemes, such as the LETI Rating System is helpful in identifying progress against best practice at the same time. Therefore, the LETI Rating System bandings have been referred to throughout this assessment.

The purpose of this report is to focus on the actions required to minimise upfront embodied carbon and consider whole life cycle carbon in conjunction with whole life costing for the project.

Upfront Carbon, A1-5 (exc. sequestration)					
Band	Office	Residential	Education	Retail	
A++	<100	<100	<100	<100	
A+	<225	<200	<200	<200	
A	<350	<300	<300	<300	LETI 2030 Design Target
B	<475	<400	<400	<425	
C	<600	<500	<500	<550	LETI 2020 Design Target
D	<775	<675	<625	<700	
E	<950	<850	<750	<850	
F	<1100	<1000	<875	<1000	
G	<1300	<1200	<1100	<1200	

Embodied Carbon, A1-5, B1-5, C1-4 (inc. sequestration)					
Band	Office	Residential	Education	Retail	
A++	<150	<150	<125	<125	
A+	<345	<300	<260	<250	
A	<530	<450	<400	<380	
B	<750	<625	<540	<535	RIBA 2030 Built Target
C	<970	<800	<675	<690	
D	<1180	<1000	<835	<870	
E	<1400	<1200	<1000	<1050	
F	<1625	<1400	<1175	<1250	
G	<1900	<1600	<1350	<1450	

All values in kgCO₂e/m² (GIA)

Figure 1-1: LETI Rating System Bandings

1.3 Site and Building Description

The building is part of a commercially led mixed use development on the site that includes an exciting mix of new workspace, leisure opportunities and high-quality student accommodation.

Plot 10 is just behind No.1 First Street and James Grigor Square; the site bounded by Hulme Street, River Street and Newcastle Street.

This plot was first outlined in the 2012 update to the First Street Strategic Development Framework (SDF), as part of the Central development zone. The 2018 masterplan envisaged two buildings on the site mirroring Plots 9a and 9b in orientation. The buildings on Plot 10 have been re-orientated to create more choice in the type of office space available and support a new mix of uses without diluting the commercial office focus of the area.

The building will have a post tensioned concrete frame structure with floor to ceiling height of 2,80 m and 4,06 m floor to floor height. Its exterior will include precast concrete façade (60%) with glazing (40%) including openable windows covered by perforated aluminium panels and inverted roof.

The development is to have a low embodied carbon and material use impact. A Design for Performance NABERS rating of 5.5 stars is targeted.

In line with this context the 2020 LETI targets for a commercial office may be applicable as the LETI 2020 target for new construction is 600 kgCO₂e/m² without sequestration for substructure, superstructure, MEP, façade and internal finishes.



Figure 1-2: Architects' visual of the building- Plot 10a, provided by Jon Matthews Architects

1.4 Study Background

Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime, from the emissions associated with raw material extraction, the manufacture and transport of building materials, to installation/construction, operation, maintenance and eventual material disposal.

Operational carbon emissions will make up a declining proportion of a development's whole life carbon emissions as operational carbon targets become more stringent. To fully capture a development's carbon impact, a whole life-cycle approach is needed to capture its unregulated emissions (i.e. those associated with equipment), its embodied emissions (i.e. those associated with raw material extraction, manufacture and transport of building materials, and construction) and emissions associated with maintenance and eventual material disposal.

Calculating and reducing WLC emissions offers a wealth of benefits including:

1. Ensuring that a significant source of emissions from the built environment are accounted for, which is necessary in achieving a net zero-carbon city.
2. Achieving resource efficiency and cost savings by encouraging the re-use of existing materials instead of new materials and the retrofit and retention of existing structures and fabric over new construction.
3. Identifying the carbon benefits of using recycled material and the benefits of designing for future reuse and recycling to reduce waste and support the circular economy.
4. Identifying the impact of maintenance, repair and replacement over a building's life-cycle, which improves life-time resource efficiency and reduces life-cycle costs, contributing to the future proofing of asset value.
5. Encouraging local sourcing of materials and short supply chains, with resulting carbon, social and economic benefits for the local economy.
6. Encouraging durable construction and flexible design, both of which contribute to greater longevity, reduced obsolescence of buildings and avoiding carbon emissions associated with demolition and new construction.

1.5 Life-cycle modules

The WLC assessment covered all modules A, B and C set out in BS EN 15978 and the RICS Professional Statement: Whole Life Carbon assessment for the built environment (referred to as the RICS PS for the remainder of this document), in the life of a typical project described as life-cycle modules. The reference study period (i.e. the assumed building life expectancy) for the purposes of the assessment is 60 years.

To provide a holistic view of the GWP, the whole life carbon assessment accounts for all components relating to the project during all life stages. Embodied Carbon emissions are attributed to four main categories taken from BS EN 15978. The categories are:

1. **Product Stages (module A1 to A3):** The carbon emissions generated at this stage arise from extracting the raw materials from the ground, their transport to a point of manufacture and then the primary energy used (and the associated carbon impacts that arise) from transforming the raw materials into construction products.
2. **Construction (module A4 to A5):** These carbon impacts arise from transporting the construction products to site, and their subsequent processing and assembly into the building.
3. **In-Use Stages (module B1 to B5):** This covers a wide range of sources from the embodied carbon emissions associated with the operation of the building, including the materials used during maintenance, replacement and refurbishment. *Module B6 and B7 refer to operational emissions and are not included in this assessment.*
4. **End of Life Stages (module C1 to C4):** The eventual deconstruction and disposal of the existing building at the end of its life takes account of the on-site activities of the demolition contractors. No 'credit' is taken for any future carbon benefit associated with the reuse or recycling of a material into new products.
5. **Benefits and loads beyond the system boundary (module D):** Any potential benefit from the reuse, recovery and recycling potential of a building or a building product. *This module is not included in the assessment scope of this study.*

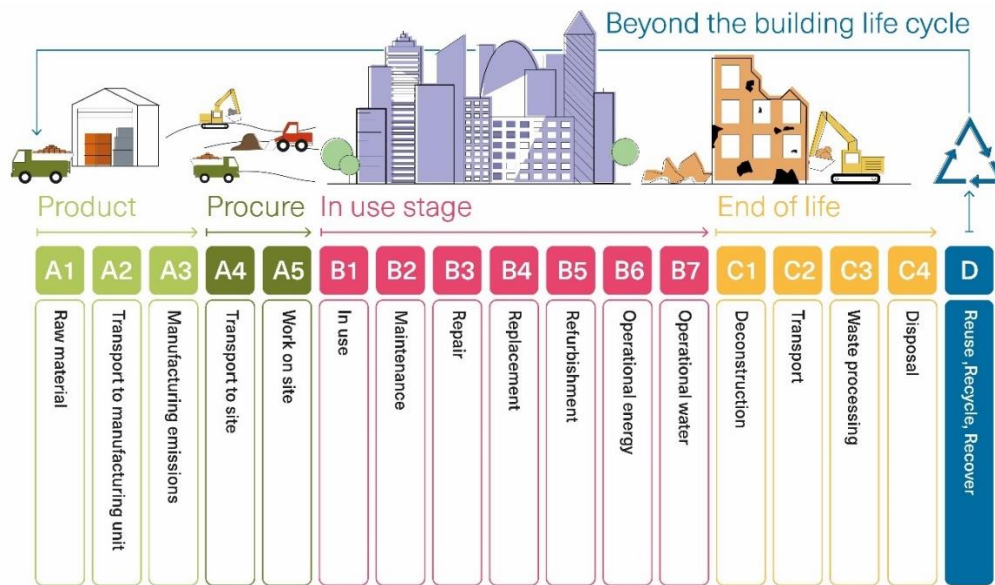


Figure 1-3: Life Cycle Modules as per BS EN 15978

1.6 Methodology

The assessment follows a nationally recognised assessment methodology, namely, BS EN 15978: 2011: (Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method).

Underpinning BS EN 15978 is the RICS Professional Statement: Whole Life Carbon assessment for the built environment (RICS PS). The RICS PS serves as a guide to the practical implementation of the BS EN 15978 principles. It sets out technical details and calculation details and so was used as the methodology for the assessment.

This study covers; Upfront Embodied Carbon (A1-A5); Life cycle Embodied Carbon (B-C, excluding B6, B7); Carbon reduction options.

1.7 Assessment Scope

The building components included in the assessment are illustrated in Figure 1-4.

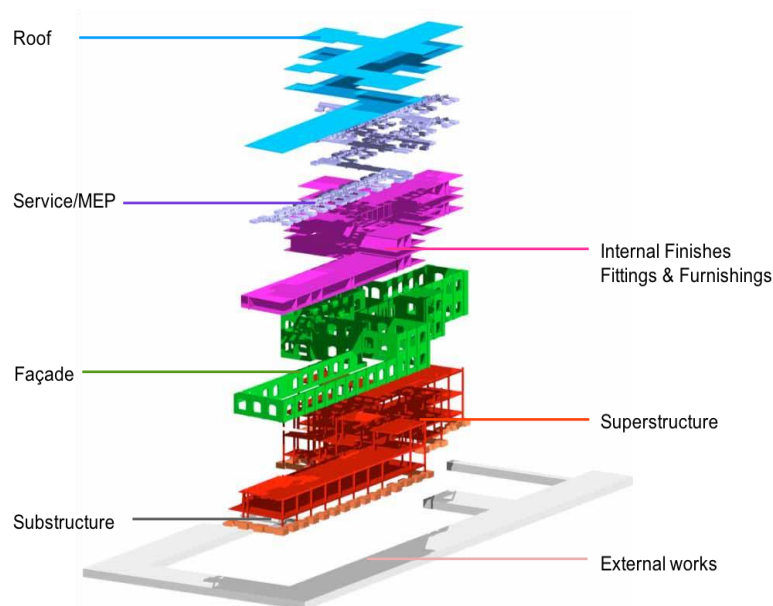


Figure 1-4: Indicative 3D Model of scope of elements analysed for embodied carbon impact

1.8 Data sources

1.8.1 Project specific information

The project information (including Gross Internal Area, material quantities and specifications) used to inform this assessment has been gained from the following sources:

Information	Consultant	Reference
Architectural	John Matthews Architects	Presentation report Architecture layouts
Structural	Ramboll	Not available
MEP	Cundall	Not available
Landscape	Planit-ie	Landscape layouts
Cost plan	Gardiner &Theobald	Stage 2 Cost Plan
Total GIA	28,759 (m ²)	Stage 2 Cost Plan

Table 1-2:

1.8.2 RICS Professional Statement Guidance

The below material specific data were provided and incorporated in the assessment as can be seen in figure 1-5.

ID	ELEMENT	CONCRETE GRADE	REINFORCEMENT RATE/ALLOWANCE
1	Core Walls	RC40/50	150kg/m ³ – walls 350kg/m ³ - spandrels
2	Columns	RC40/50	300kg/m ³ Level 0 - Level 1 275g/m ³ Typical upper floor level
3	PT suspended slab (275/300mm th'k) ***	RC40/50	75kg/m ³ (20kg/m ²) 170 shear studs per internal column 250 shear studs per edge column
		PT Tendons	6.0kg/m ²
4	RC infill slab (all levels)	RC40/50	150kg/m ³
5	Roof Upstands	RC32/40	100kg/m ³
6	Pile caps	RC32/40	150kg/m ³
7	Core caps	RC32/40	200kg/m ³
8	Suspended ground slab (250mm th'k)	RC32/40	175kg/m ³
9	Ground Bearing slab	RC30/37	60kg/m ³
10	Ground Bearing slab edge	RC30/37	120kg/m ³
11	Retaining walls	RC32/40	140kg/m ³
12	Liner walls	RC32/40	140kg/m ³
13	Capping beam	RC40/50	350kg/m ³
14	Basement slab	RC32/40	150kg/m ³

Figure 1-5 Data sources

Where information has otherwise not been provided or is unavailable, the assumptions taken from the RICS professional statement guidance were adopted, as displayed in Table 1-3 to Table 1-5.

Material	Details	Specification
Concrete	Piling	C32/40 20% cement replacement
	Substructure	C32/40 20% cement replacement
	Superstructure	C32/40 20% cement replacement
	Generic concrete	C16/20 0% cement replacement
Steel	Reinforcement bars	97% Recycled Content
	Structural steel sections	20% Recycled Content
	Studwork/Support frames	Galvanised steel, 15% Recycled Content
Blockwork	Precast concrete blocks	Lightweight blocks for building envelope
	Precast concrete blocks	Dense blocks for other uses
Timber	Manufactured structural timber CLT, Glulam, etc.	100% FSC/PEFC
	Formwork	Plywood
	Studwork/Framing/Flooring	Softwood

Material	Details	Specification
Aluminium	Cladding panels	Aluminium sheet, 35% Recycled Content
	Glazing frames	Aluminium sheet, 35% Recycled Content
Plasterboard	Partitioning/Ceilings	Min. 60% Recycled Content
Insulation	To floors, roofs & external walls	PIR

Table 1-3: Default specifications for main building materials

Transport scenario	km by road	km by sea
Locally manufactured e.g. concrete, aggregate, earth	50	-
Nationally manufactured e.g. plasterboard, blockwork, insulation	300	-
European manufactured e.g. CLT, façade modules, carpet	1,500	-
Globally manufactured e.g. specialist stone cladding	200	10,000

Table 1-4: Default transport scenarios for UK projects

Building part	Building elements/components	Expected lifespan
Roof	Roof coverings	30 years
Superstructure	Internal partitioning and dry lining	30 years
Finishes	Wall finishes: Render/Paint	30/10 years respectively
	Floor finishes Raised Access Floor (RAF)/Finish layers	30/10 years respectively
	Ceiling finishes Substrate/Paint	20/10 years respectively
FF&E	Loose furniture and fittings	10 years
Services/MEP	Heat source, e.g. boilers, calorifiers	20 years
	Space heating and air treatment	20 years
	Ductwork	20 years
	Electrical installations	30 years
	Lighting fittings	15 years
	Communications installations and controls	15 years
	Water and disposal installations	25 years
	Sanitaryware	20 years
	Lift and conveyor installations	20 years
Façade	Opaque modular cladding e.g. rain screens, timber panels	30 years
	Glazed cladding/Curtain walling	35 years
	Windows and external doors	30 years

Table 1-5: Default life span assumptions

2.0

Whole Life Carbon Assessment

2.0 Whole Life Carbon Assessment

2.1 Assessment Result

2.1.1 Overview

The total embodied carbon emissions for **Plot 10a** for both Upfront Embodied Carbon and Life Cycle Embodied carbon over a period of 60 years are shown in Table 2-1 below. This is based upon the design information received.

As shown in section 2.1.2 – 2.1.2 the results for Plot 10a show that the development is currently close to meeting the upfront embodied carbon and are meeting the whole life carbon targets.

In addition, to achieve the best possible embodied carbon result, the development can incorporate design elements to lower the embodied carbon further.

The following results are aligned with LETI scope and do not include external works and F, F&E which are reported separately.

Plot 10a Carbon Emissions	Upfront Embodied Carbon (A1-A5)	Life Cycle Embodied Carbon (Module B to C excl. B6, B7)	Whole Life Embodied Carbon (A-C)
Tonnes CO ₂ e	18,187	11,229	29,416
kgCO ₂ e/m ² (GIA)	632	390	1,023
LETI Rating System	D	-	D

Table 2-1: Upfront embodied carbon target and Stage 2 results

The following results represent the results for external works and F, F&E categories.

Plot 10a Carbon Emissions	Upfront Embodied Carbon (A1-A5)	Life Cycle Embodied Carbon (Module B to C excl. B6, B7)	Whole Life Embodied Carbon (A-C)
Fittings, furnishings & equipment -Tonnes CO ₂ e	94	465	559
External work- Tonnes CO ₂ e	38	27	66
kgCO ₂ e/m ² (GIA)	5	17	22

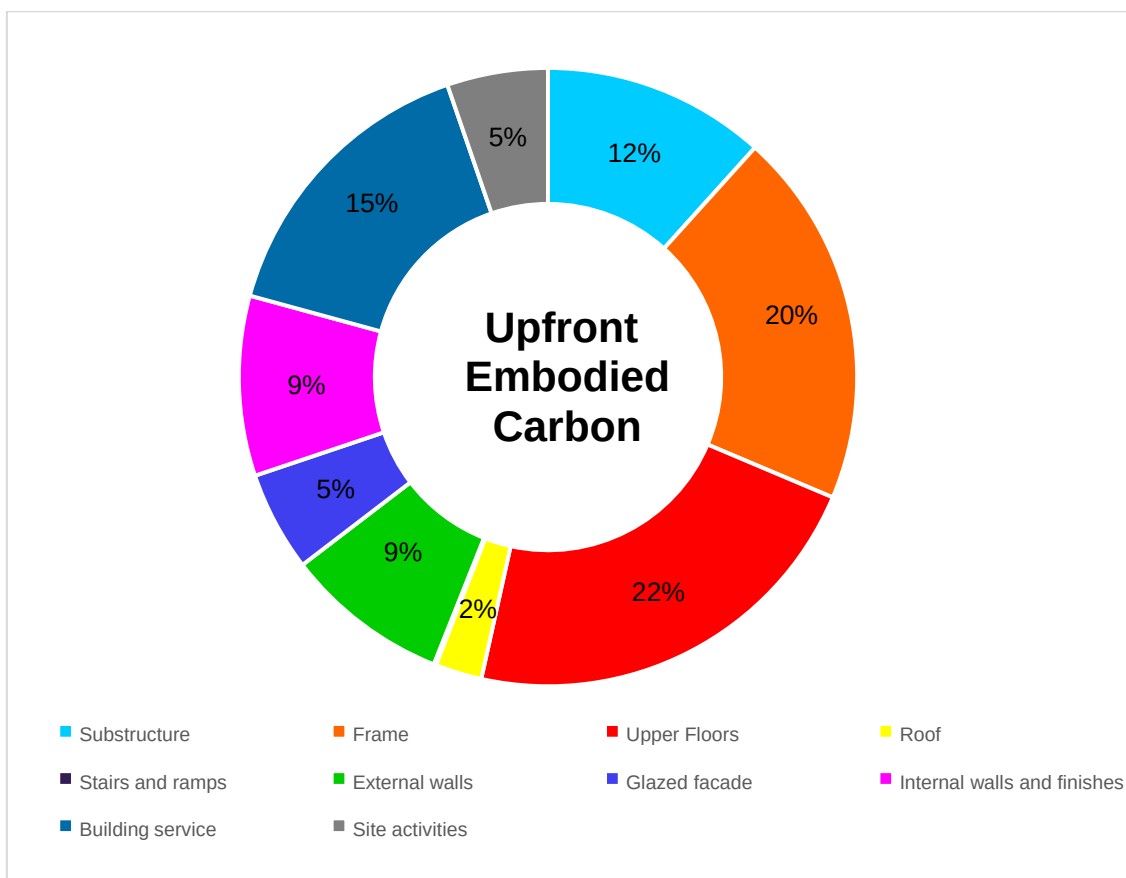
Table 2-2: Upfront embodied carbon target and Stage 2 results

2.1.2 Embodied Carbon Breakdown

Graphs in Figure 2-1 below show the proportional contribution of the different building element groups to both the upfront and whole life embodied carbon for **Plot 10a** building. Figure 2-1 shows the embodied carbon breakdown by building element group for the different life cycle modules.

Key findings:

1. Most of the carbon emissions occur as upfront embodied carbon.
2. Substructure, frame, roof and upper floors contribute ~ 56% of the upfront embodied carbon
3. Glazing area of the façade contribute ~ 5% of the upfront embodied carbon
4. Building services alone contribute ~ 15% of the upfront embodied carbon



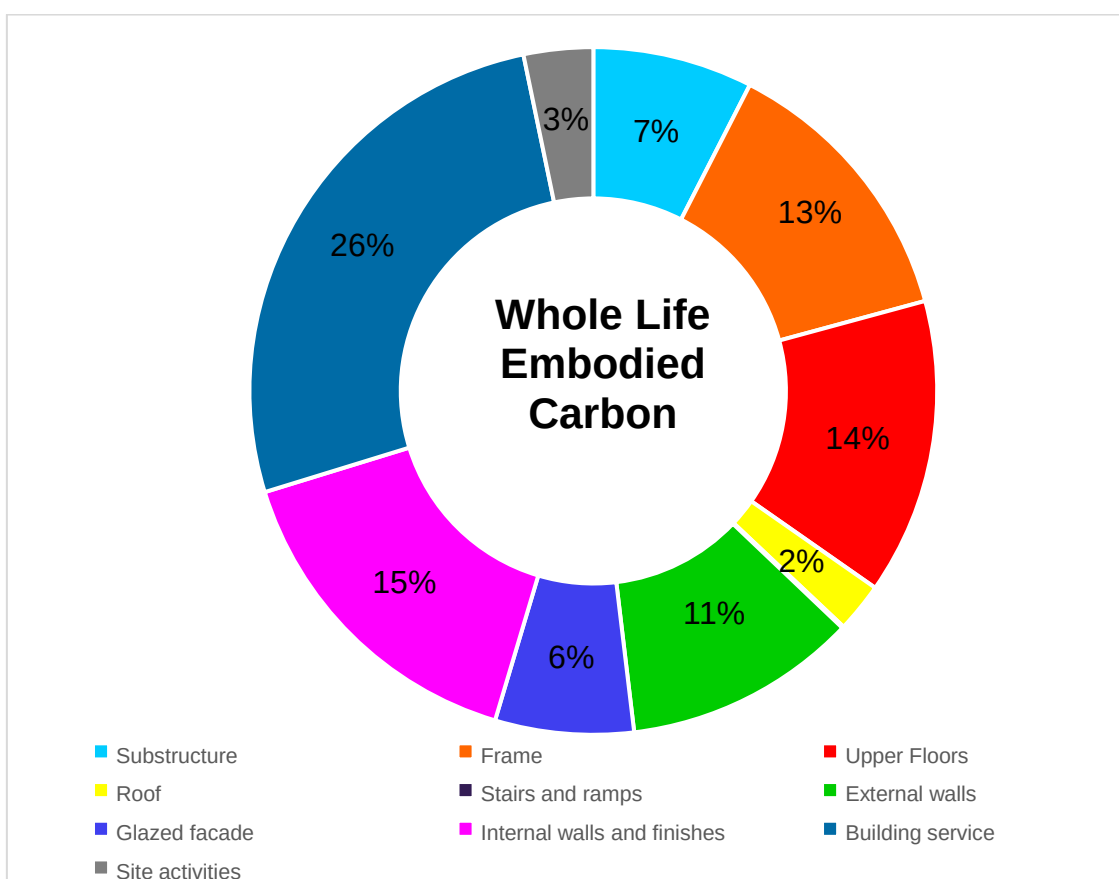


Figure 2-1: Embodied carbon breakdown by Building Element group

Embodied Carbon over Life Cycle (TCO ₂ e)		Upfront Carbon [A1-A5]	Life cycle impacts [B2-B5]	End of life impacts [C1-C4]	Whole Life Carbon (TCO ₂ e)
Substructure		2,124	-	90	2,214
Superstructure	Frame	3,580	300	20	3,900
	Upper Floors	4,020	-	75	4,095
	Roof	444	210	31	685
	Stairs and ramps	21	-	1	22
	External walls	1,560	1,605	69	3,235
	Glazed facade	951	957	8	1,916
Finishes	Internal walls and finishes	1,712	1,759	1,127	4,598
Building service		2,815	4,958	19	7,791
Site Activities		960	-	-	960
Total Embodied Carbon		18,187	9,789	1,440	29,416
Embodied Carbon intensity (kg CO₂e/m² GIA)		632	340	50	1,023
Below items are not within LETI rating scopes					
F, F&E		94	455	10	559
External Works		38	26	1	66

Table 2-3: Embodied Carbon Breakdown by Building Element Group

2.2 Comparison with LETI Targets

When comparing **Plot 10a** with LETI targets, as shown in Table 2-4 below, the result for the total upfront embodied carbon is in line with expectations.

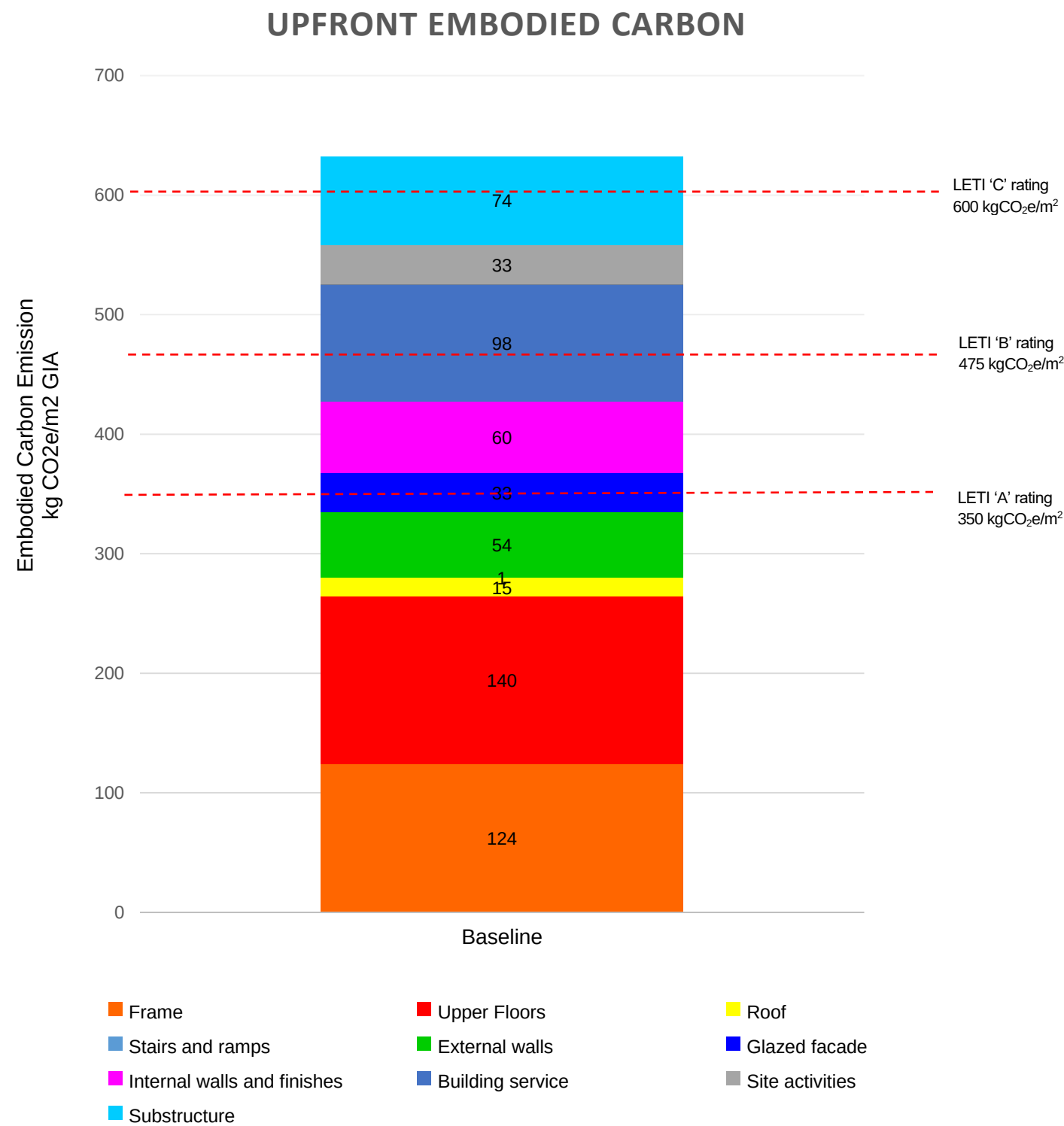


Figure 2-2: Total Upfront Embodied Carbon Comparison with LETI Benchmark

2.3 Comparison with First Street Plot 9a

Figure 2-3 below compares the upfront embodied carbon footprint (excluding B6-B7) at Stage 2 for **Plot 10a** with **Plot 9a** & other case study office projects.

Aligned with LETI Scope	Plot 10a	Plot 9a
	Upfront Embodied Carbon LETI (A1-A5)	Upfront Embodied Carbon LETI (A1-A5)
Tonnes CO ₂ e	18,187	13,989
kgCO ₂ e/m ² GIA	632	736
LETI Rating System	D	D

Table 2: Upfront embodied carbon comparison for Plot 10a & Plot 9a.

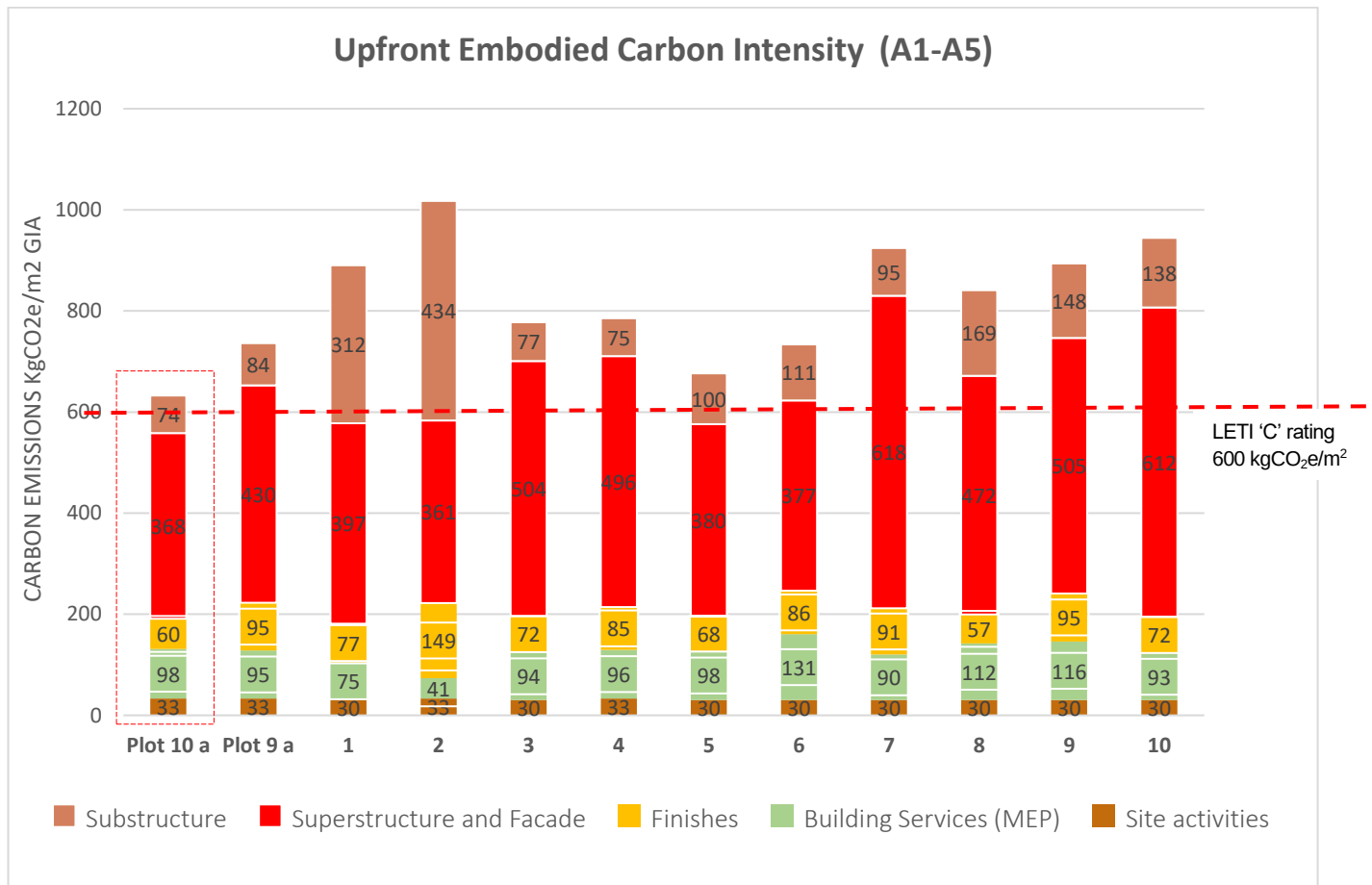


Figure 2-3: Total Upfront Embodied Carbon Comparison with other office projects.

3.0

Whole Life Carbon Reduction Options

3.0 Whole Life Carbon Reduction Options

3.1 Overview

The project can look at several of the sub-elements when reducing the embodied carbon. The 'carbon hotspots' are identified as the:

- Substructure
- Frame
- Upper floors and roof
- Internal finishes
- Facade

The options are applied retrospectively and demonstrate in theory how much embodied carbon could potentially be saved. This could serve as guidance for future projects. It should be noted that these carbon reduction material suggestions have been considered in reference to carbon embodiment only, and other influencing factors, such as fire safety, must be taken into account and assessed by suitably qualified team members before adoption in the design.

3.2 Substructure and frame

3.2.1 Concrete

Concrete is currently a carbon hotspot for the buildings, and improvements beyond the baseline for all buildings could be realised by increasing cement replacement.

Considering high cement replacement content with GGBS (Ground Granulated Blast-furnace Slag) or PFA (Pulverised Fuel Ash) could deliver great carbon savings. For instance, having 50% GGBS cement replacement, as per a CEM IIIA mix, would reduce the carbon footprint of the concrete by around 40-45% beyond a CEM I baseline.

Another consideration factor is the transportation of concrete. If in-situ concrete could be sourced from a nearby concrete plant (i.e. 10-25 km away), this could further reduce the carbon impact of the concrete.

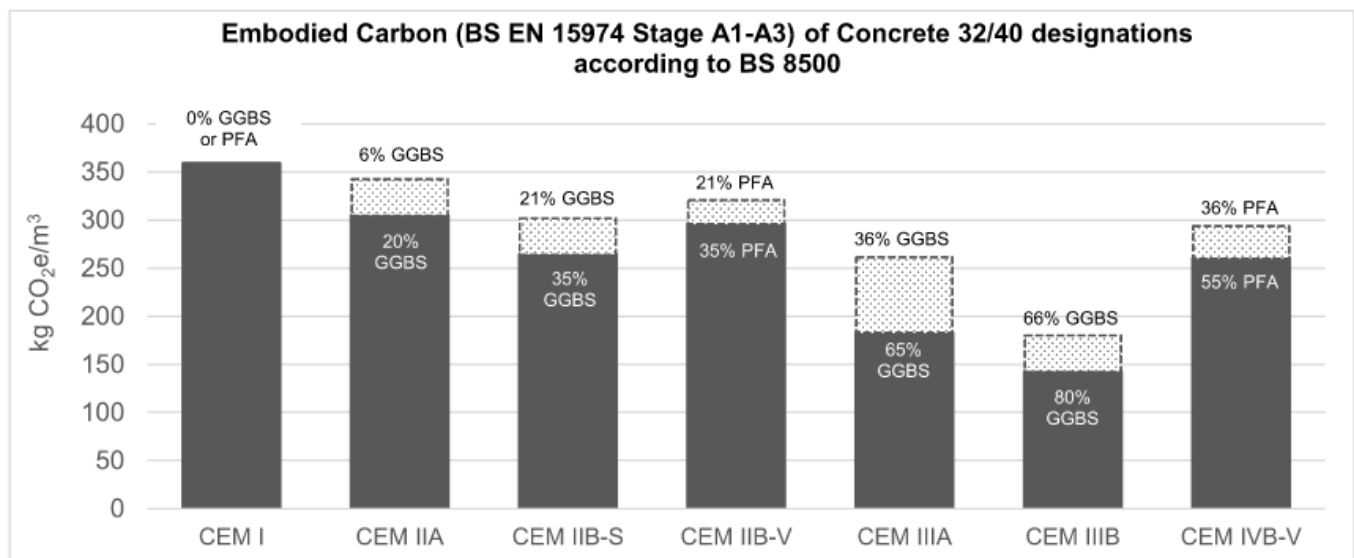


Figure 3-1: Embodied carbon of concrete with different cement replacement ranges

3.2.2 Steel

Structural steel used across the building is considered a 'carbon hotspot', sourcing steel made from recycled materials will reduce its impact significantly.

Structural steel with high recycled content is achieved through the Electric Arc Furnace (EAF) process, which uses scrap steel melted down. Therefore, a recycled content of 100% is possible. In terms of the steel market, around 20% steel plants in the UK use EAF, which makes it more challenging to source nationally.

Early involvement of steel contractor is recommended to identify appropriate EAF procurement strategy. EAF-produced steel is more likely to come from European countries, however the carbon saved in production significantly outweighs any carbon increase from transportation.

Table 3-1 below shows the embodied carbon of the steel produced by different furnace types.

Furnace type	Recycled Content	Embodied Carbon (Product stage A1-A3)
Basic Oxygen Furnace (BOF)	20%	2.51 kg CO2/kg
Electric Arc Furnace (EAF)	80%	0.97 kg CO2/kg

Table 3-1: Embodied carbon of steel from different furnace types

3.3 Facade

The façade is also expected to be a 'carbon hotspot' of the design, both in terms of its upfront embodied carbon, but also that over the life cycle of the building due to high levels of maintenance required and replacement events.

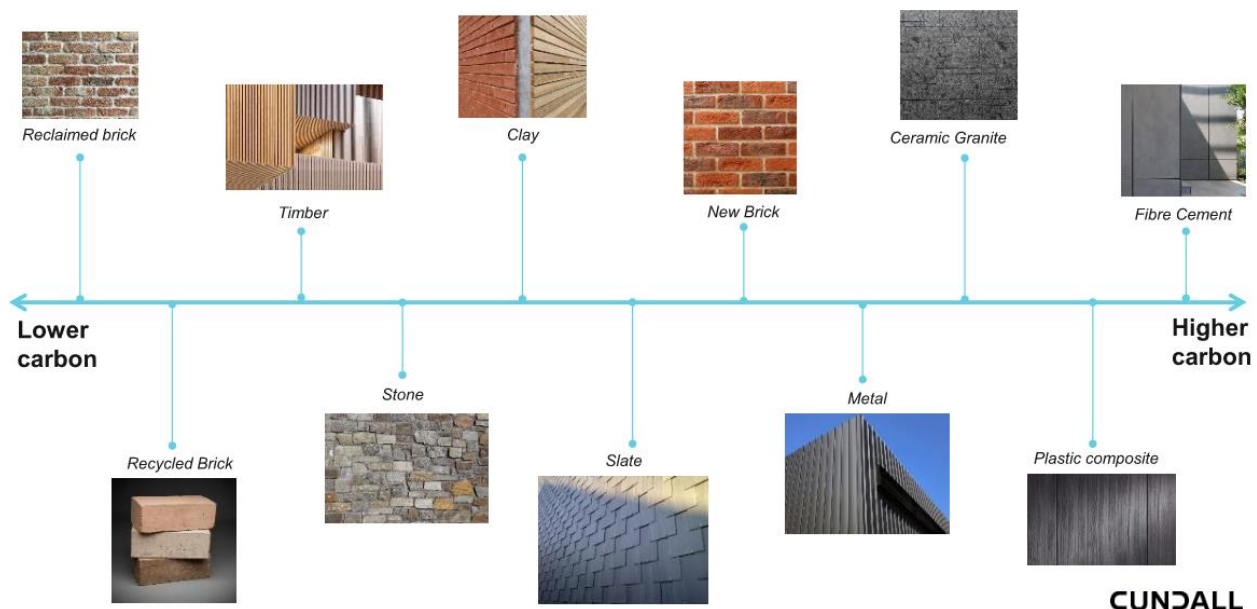


Figure 3-2: High level overview of embodied carbon in different cladding materials

Different façade options have been considered for the glazed units that will have a high proportion of glazing between aluminium, combi and timber framed.

It has been advised that combi or full timber framed glazing is preferred but where aluminium framed glazing is chosen, then it is advised that they have a high as possible recycled content.

Therefore, the following suggestions could be applied to see improvement to the baseline:



Figure 3-1: Example of timber and aluminium combi window

1. Considering timber framed or combi (aluminium clad timber framed) curtain walling and windows.
2. Consider Polyester Powder Coated (PPC) aluminium in lieu of anodized aluminium, as the former can use high recycled content and is easier to repair on-site.

3.4 Internal finishes

Most of the internal walls are stud partition walls however where the internal walls are made of blockwork, consider blockwork with high recycled content, as this will reduce its embodied carbon.

The development, being largely made up of office space currently incorporates raised access flooring and potentially an exposed ceiling, with only suspended ceilings to the core and toilet areas.

The finishes include both porcelain and carpet tiling for the floors, as well as enhanced finishes to reception area, assumed to be vinyl. The wall finishes include paint, porcelain tiling to bathroom areas and plasterboard.

Improvement could be expected when switching to reused and recycled materials:

1. Consider tiles containing high recycled content.
2. Consider low carbon paint, such as Dulux Trade Supermatt.
3. Consider plasterboard with a high recycled content such as Fermacell TM.

The environmental impact of the internal finishes will be reviewed further during the next stages.

3.5 Carbon Reduction Summary

To reduce the amount of embodied carbon in the development the following options are recommended.

Option	Element	Specification	Potential carbon saving for the project (Upfront Embodied Carbon)	
			tonnes CO ₂ e	kgCO ₂ e/m ²
1	Substructure	70% Ground Granulated Blast Furnace Slag (GGBS) in foundations and lowest floor construction	390	15
2	Substructure/ Superstructure	Local sourcing of in-situ concrete <10km	215	8
3	Superstructure	Structural steel made from recycled materials (produced from Electric Arc Furnace)	52	2
4	Superstructure	50% Ground Granulated Blast Furnace Slag (GGBS) in upper floors and roof	589	23
5	Roof	Rockwool rigid insulation for flat roof	87	3
6	Facade	Lower EC for the curtain walling	158	6
7	Internal partition walls	Low carbon plasterboard (Fermacell or equivalent)	52	2
8	Wall finishes	Low carbon paint	9	<1
9	Floor finishes	Low carbon ceramic tiles	34	1
10	Floor finishes	Reclaimed raised access floor system for offices	800	31
Total Carbon saving			2,387	91

Table 3-2: Summary of carbon reduction options

If all of the options could be adopted, the life cycle emissions (A-C) could be reduced by about **2,387 tonnes CO₂e**, which is a 13% reduction from the current position.

UPFRONT EMBODIED CARBON

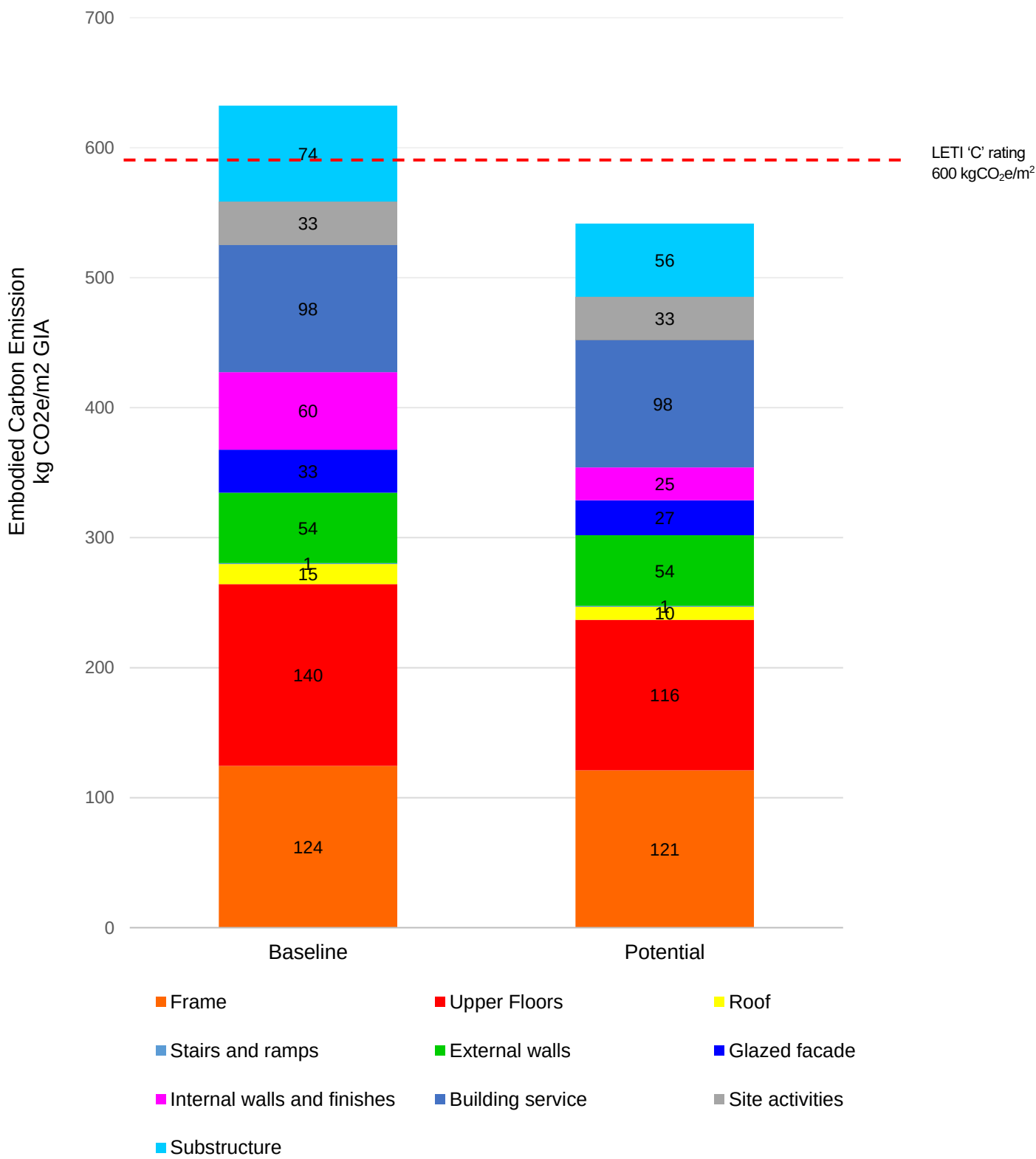


Figure 3-5 Whole Life Carbon Reduction Potential

Plot 10a (Aligned with LETI Scope)	Baseline Design	Potential
	Upfront Embodied Carbon LETI (A1-A5)	Upfront Embodied Carbon LETI (A1-A5)
Tonnes CO ₂ e	18,187	15,800
kgCO ₂ e/m ² GIA	632	541
LETI Rating System	D	C

Table 3-3: Whole life carbon comparison of baseline with potential improvement for Plot 10a for Options 1-10

4.0

Conclusion

4.0 Conclusion

4.1 Summary

This assessment reviewed the carbon footprint data of the proposed development. The breakdown of total embodied carbon emissions for both Upfront Embodied Carbon and Whole Life Embodied Carbon over a period of 60 years, were found to be:

- Upfront Embodied Carbon = **632** kg CO₂e/m² (18,187 tonnes CO₂e)
- Whole Life Embodied Carbon = **1,023** kg CO₂e/m² (29,416 tonnes CO₂e)

4.2 Reduction Options

The assessment has identified a series of material alternatives that could be applied to the development to reduce its carbon footprint. To achieve this, we recommend the following changes to the current design be considered:

1. High cement replacement for concrete 70% GGBS in foundations, retaining wall, lowest floor construction.
2. Local sourcing of all in-situ concrete <10km in superstructure
3. Structural steel frame made from recycled materials (produced from Electric Arc Furnace) - columns
4. High cement replacement for concrete 50% GGBS in upper floors and roof.
5. Rockwool rigid insulation for flat roof
6. Lower EC for the curtain walling
7. Low carbon plasterboard (Fermacell or equivalent) internal partitions and walls
8. Low carbon wall paint
9. Low carbon ceramic floor finishes
10. Reclaimed raised access floor system for offices.

4.3 Key considerations and next steps

Of the options identified, most would be expected to be cost neutral or better. During the next stages we would recommend further exploration of materials that could potentially be reused from the existing building and site as this will make further reductions on the embodied carbon as fewer new (virgin) materials will be required

- Investigate the feasibility of these options with the design team and QS.
- Review the internal finishes in more detail.
- Continue to assess design updates and provide low carbon alternatives.

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